

**Acute Nonlocalized Abdominal Pain  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Mindelzun RE, Jeffrey RB. Unenhanced helical CT for evaluating acute abdominal pain: a little more cost, a lot more information. <i>Radiology</i> . 1997;205(1):43-45.	Review/Other-Dx	N/A	Review data on cost effectiveness and diagnostic accuracy of unenhanced helical CT in acute abdominal pain.	Helical CT provides clinically relevant information at a reasonable cost.	4
2. Otoni JC, Noschang J, Okamoto TY, et al. Role of computed tomography at a cancer center emergency department. <i>Emerg Radiol</i> . 2017;24(2):113-117.	Observational-Dx	3788 patients	To evaluate the imaging methods used at the emergency department (ED) of a cancer center, with emphasis on computed tomography (CT).	During the study period, there were 8710 visits to the ED, and 5999 imaging studies were requested in 3788 patients (43.5 % of total of visits). One thousand eight hundred twenty-nine CT exams were used in 1121 visits (12.9 % of total of visits). The mean age of patients was 57.7 years and most patients (93.2 %) had a known primary tumor. The most common indications for abdominopelvic CT were non-oncologic emergencies (26.7 %) and postoperative complications (19.2 %), and the results were negative in 36.6 %, positive for clinical suspicion in 49.0 %, and incidental positive in 14.5 %. The most frequent indication for chest CT was suspected pulmonary embolism (34.4 %); however, only 11.1 % confirmed the diagnosis. The results of head TC were negative in 72.9 % and the indications that had more positive findings were suspected metastasis (32.1 %) and focal neurological sign/altered level of consciousness (24.5 %).	4

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<p>3. Pandharipande PV, Reisner AT, Binder WD, et al. CT in the Emergency Department: A Real-Time Study of Changes in Physician Decision Making. Radiology. 2016;278(3):812-821.</p>	<p>Observational-Dx</p>	<p>1280 patients</p>	<p>To determine how physicians' diagnoses, diagnostic uncertainty, and management decisions are affected by the results of computed tomography (CT) in emergency department settings.</p>	<p>Both surveys were completed for 1280 patients by 245 physicians. The leading diagnosis changed in 235 of 460 patients with abdominal pain (51%), 163 of 387 with chest pain and/or dyspnea (42%), and 103 of 433 with headache (24%). Pre-CT diagnostic confidence was inversely associated with the likelihood of a diagnostic change (P &lt; .0001). Median changes in confidence were substantial (increases of 25%, 20%, and 13%, respectively, for patients with abdominal pain, chest pain and/or dyspnea, and headache; P &lt; .0001); median post-CT confidence was high (95% for all three groups). CT helped confirm or exclude at least 95% of alternative diagnoses. Admission decisions changed in 116 of 457 patients with abdominal pain (25%), 72 of 387 with chest pain and/or dyspnea (19%), and 81 of 426 with headache (19%). During follow-up, 70 of 450 patients with abdominal pain (15%), 53 of 387 with chest pain and/or dyspnea (14%), and 49 of 433 with headache (11%) returned for the same indication. In general, changes in leading diagnosis, diagnostic confidence, and admission decisions were not well explained with site or participant characteristics.</p>	<p>2</p>

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4. Gardner CS, Jaffe TA, Nelson RC. Impact of CT in elderly patients presenting to the emergency department with acute abdominal pain. <i>Abdom Imaging</i> . 40(7):2877-82, 2015 Oct.	Observational-Dx	464 patients	To document the clinical impact of CT in elderly patients presenting to the emergency department (ED) with abdominal pain.	CTs were positive in 55%. The most common diagnoses were SBO (18%), diverticulitis (9%), non-ischemic vascular-related emergency (6%), bowel ischemia (4%), appendicitis (3%), and colonic obstruction (2%). These diagnoses were clinically unsuspected prior to CT in 43% ( $p < 0.05$ ), with significant difficulty in diagnosing SBO ( $p < 0.05$ ), diverticulitis ( $p < 0.01$ ), and colonic obstruction ( $p < 0.01$ ). Positive CT results influenced treatment plans in 65%, surgical in 48%, and medical in 52%. Disposition from the ED was significantly affected by CT ( $p < 0.001$ ), 65% of admissions with positive CT ( $p < 0.001$ ) and 63% of discharges with negative CT ( $p < 0.001$ ).	3
5. Lewis LM, Klippel AP, Bavolek RA, Ross LM, Scherer TM, Banet GA. Quantifying the usefulness of CT in evaluating seniors with abdominal pain. <i>Eur J Radiol</i> . 2007;61(2):290-296.	Observational-Dx	126 patients	Prospective observational study to: 1) determine if older patients with abdominal pain who receive emergency department abdominal CT have changes in diagnosis and/or disposition more often than similar patients without CT; 2) compare physician confidence in diagnosis and disposition for patients with vs without CT; and 3) document factors that most influence physician's decision to order abdominal CT in this population.	Abdominal CT rate was 59% (95% CI, 50%-67%). CT was associated with an increased change in diagnosis (46%; 95% CI, 4%-58% vs 29%; 95% CI, 16%-42%), but no change in disposition between patients with vs without CT. Preliminary diagnostic confidence was lower for emergency physicians who ordered a CT than for those who did not ( $P < 0.001$ ). Patient history most influenced ordering CT, whereas prior lab/imaging results most influenced not ordering CT. Patients with CT had a change in diagnosis more often than those without. Preliminary diagnostic confidence was lower in CT group. Percent change in disposition did not differ between groups. Physicians most often ordered CT based on history and did not order CT when other diagnostic evaluation supported a specific diagnosis.	3

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6. Yeh EL, McNamara RM. Abdominal pain. [Review] [52 refs]. Clin Geriatr Med. 23(2):255-70, v, 2007 May.	Review/Other-Dx	N/A	To review abdominal pain in the elderly, discuss the clinical approach, and highlight key diagnostic considerations.	Complaint of abdominal pain in an elderly patient must be considered seriously. It may require referral to an emergency department, extensive diagnostic testing, surgical consultation, and consideration of admission for observation until the patient's condition is clarified.	4
7. Spencer SP, Power N, Reznick RH. Multidetector computed tomography of the acute abdomen in the immunocompromised host: a pictorial review. Curr Probl Diagn Radiol. 2009;38(4):145-155.	Review/Other-Dx	N/A	Review causes of acute abdomen in the immunocompromised host, illustrate the typical findings on MDCT, and discuss potential limitations of MDCT in diagnosing these conditions.	MDCT is a powerful modality for pinpointing the most likely site and cause of acute abdominal pain in the immunocompromised host.	4
8. Badgwell BD, Cormier JN, Wray CJ, et al. Challenges in surgical management of abdominal pain in the neutropenic cancer patient. Ann Surg. 2008;248(1):104-109.	Observational-Dx	60 patients	Retrospective study to characterize the clinicopathologic factors associated with the presentation of neutropenia and abdominal pain, examine the treatment strategies used, and define associated outcomes for these patients.	The most frequent causes of the abdominal pain were neutropenic enterocolitis (28%) and SBO (12%); the cause remained uncertain in 35%. Surgical interventions had been performed in 9 patients. The 30- and 90-day mortality rates for all patients were 30% and 52%, respectively. Multivariate analysis revealed that severe sepsis, a relatively long duration of neutropenia, and the lack of surgical intervention were significant adverse prognostic factors for overall survival. Abdominal pain as a symptom in neutropenic patients continues to be a diagnostic and therapeutic challenge and is associated with a high mortality rate.	3
9. American College of Radiology. ACR Appropriateness Criteria®: Right Upper Quadrant Pain. Available at: <a href="https://acsearch.acr.org/docs/69474/Narrative/">https://acsearch.acr.org/docs/69474/Narrative/</a> .	Review/Other-Dx	N/A	Evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for a specific clinical condition.	N/A	4

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10. American College of Radiology. ACR Appropriateness Criteria®: Left Lower Quadrant Pain-Suspected Diverticulitis. Available at: <a href="https://acsearch.acr.org/docs/69356/Narrative/">https://acsearch.acr.org/docs/69356/Narrative/</a> .	Review/Other-Dx	N/A	Evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for a specific clinical condition.	N/A	4
11. American College of Radiology. ACR Appropriateness Criteria®: Crohn Disease. Available at: <a href="https://acsearch.acr.org/docs/69470/Narrative/">https://acsearch.acr.org/docs/69470/Narrative/</a> .	Review/Other-Dx	N/A	Evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for a specific clinical condition.	N/A	4
12. American College of Radiology. ACR Appropriateness Criteria®: Right Lower Quadrant Pain—Suspected Appendicitis. Available at: <a href="https://acsearch.acr.org/docs/69357/Narrative/">https://acsearch.acr.org/docs/69357/Narrative/</a> .	Review/Other-Dx	N/A	Evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for a specific clinical condition.	N/A	4
13. American College of Radiology. ACR Appropriateness Criteria®: Suspected Small-Bowel Obstruction. Available at: <a href="https://acsearch.acr.org/docs/69476/Narrative/">https://acsearch.acr.org/docs/69476/Narrative/</a> .	Review/Other-Dx	N/A	Evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for a specific clinical condition.	N/A	4
14. American College of Radiology. ACR Appropriateness Criteria®: Acute Pelvic Pain in the Reproductive Age Group. Available at: <a href="https://acsearch.acr.org/docs/69503/Narrative/">https://acsearch.acr.org/docs/69503/Narrative/</a> .	Review/Other-Dx	N/A	Evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for a specific clinical condition.	N/A	4

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<p>15. Ahn SH, Mayo-Smith WW, Murphy BL, Reinert SE, Cronan JJ. Acute nontraumatic abdominal pain in adult patients: abdominal radiography compared with CT evaluation. <i>Radiology</i>. 2002;225(1):159-164.</p>	<p>Observational-Dx</p>	<p>871 patients had abdominal radiography, and 188 patients had abdominal CT</p>	<p>Retrospective study to compare the diagnostic yield of abdominal radiography with that of CT in adult patients presenting to the emergency department with nontraumatic abdominal pain.</p>	<p>Interpretation of abdominal radiographs was nonspecific in 588 (68%) of 871 patients, normal in 200 (23%), and abnormal in 83 (10%). The highest sensitivity of abdominal radiography was 90% for intra-abdominal foreign body and 49% for bowel obstruction. Abdominal radiography had 0% sensitivity for appendicitis, pyelonephritis, pancreatitis, and diverticulitis. Sensitivities of abdominal CT were highest for bowel obstruction and urolithiasis at 75% and 68%, respectively. Abdominal radiographs are not sensitive in the evaluation of adult patients presenting to the emergency department with nontraumatic abdominal pain.</p>	<p>3</p>
<p>16. Nguyen LK, Wong DD, Fatovich DM, et al. Low-dose computed tomography versus plain abdominal radiography in the investigation of an acute abdomen. <i>ANZ J Surg</i>. 2012;82(1-2):36-41.</p>	<p>Experimental-Dx</p>	<p>108 patients</p>	<p>To compare low-dose abdominal computed tomography (LDCT) with plain abdominal radiography (AR) in the primary investigation of acute abdominal pain to determine if there is a difference in diagnostic yield, the number of additional investigations required and hospital length of stay (LOS).</p>	<p>A diagnosis could be obtained in 12 (21.8%) patients investigated with AR compared to 34 (64.2%) for LDCT (P &lt; 0.001). Twenty-eight (50.9%) patients in the AR group required further imaging during their admission compared to 14 (26.4%) in the LDCT group (P= 0.009). There was no difference in the median hospital LOS (3.84 days for AR versus 4.24 days for LDCT, P= 0.83).</p>	<p>3</p>

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17. Haller O, Karlsson L, Nyman R. Can low-dose abdominal CT replace abdominal plain film in evaluation of acute abdominal pain? Ups J Med Sci. 2010;115(2):113-120.	Observational-Dx	222 patients (86 patients had APF, 60 had standard-dose CT, and 76 had low-dose CT)	Retrospective study to: Evaluate whether NCCT, including low-dose CT using 50 mAs), provides more diagnostic information than abdominal plain film in patients presenting with acute non-traumatic abdominal pain and if the use of CT can reduce the total number of additional radiograms. Compare the diagnostic outcome between standard-dose CT and low-dose CT.	NCCT gave a correct diagnosis in 50%, compared to 20% with abdominal plain film (P<0.001). The total number of additional radiograms was substantially lower in the CT group compared to the abdominal plain film group (P<0.001), and the average sum of radiation dose was similar for abdominal plain film and low-dose CT. NCCT was found to be significantly better at providing diagnostic information than abdominal plain film in patients presenting with acute abdominal pain. It reduced the number of additional radiograms, but the total patient dose remained somewhat higher in the CT group even when using low-dose CT with 50 mAs.	3

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<p>18. Kellow ZS, MacInnes M, Kurzencwyg D, et al. The role of abdominal radiography in the evaluation of the nontrauma emergency patient. <i>Radiology</i>. 2008;248(3):887-893.</p>	<p>Observational-Dx</p>	<p>874 patients interpretation of abdominal radiography was normal (n=300), nonspecific (n=406), and abnormal (n=168)</p>	<p>Retrospective study to characterize the utility of abdominal radiography for nontrauma emergency patients in a single-institution setting.</p>	<p>Of 300 patients whose abdominal radiography results were normal, 42% (n=125) had follow-up imaging; 72% (n=90) of these showed abnormal, 78% (165/212) showed nonspecific, and 87% (86/99) showed abnormal findings. Of 438 patients who did not undergo follow-up imaging, 75% (n=327) were discharged. For all indications other than catheter placement, abdominal radiography helped confirm the suspected diagnosis in 2%-8% of cases. In 37 (4%) of 874 patients, abdominal radiography was possibly helpful in changing patient treatment without a follow-up study. Abdominal radiography is often requested; however, its results contribute to patient treatment in a small percentage of cases. With the exception of catheter placement, if a patient requires investigation beyond clinical history, physical examination, and lab results, the emergency physician should be encouraged to request more definitive imaging.</p>	<p>2</p>



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19. Sala E, Watson CJ, Beadsmoore C, et al. A randomized, controlled trial of routine early abdominal computed tomography in patients presenting with non-specific acute abdominal pain. Clin Radiol. 2007;62(10):961-969.	Experimental-Dx	198 patients (99 in each arm)	Prospective randomized trial to compare the effect of an initial early CT examination vs standard practice on the length of hospital stay, diagnostic accuracy, and mortality of adults presenting with acute abdominal pain.	There was no significant difference in the length of hospital stay between the two arms (P=0.20). At randomization 36% (35/96) of CT patients and 49% (48/98) of standard practice patients were correctly diagnosed; 24 hours after randomization the correct diagnosis had been established in 84% of CT patients and 73% of standard practice patients. This refinement in diagnostic certainty was significantly better in the CT group (P<0.001). There was no difference in mortality between the two trial arms (P=0.31). Early abdominal CT in patients with acute abdominal pain improves diagnostic certainty, but does not reduce the length of hospital stay and 6 month mortality.	2
20. Sreedharan S, Fiorentino M, Sinha S. Plain abdominal radiography in acute abdominal pain--is it really necessary? Emerg Radiol. 2014;21(6):597-603.	Observational-Dx	108 patients	To audit the ordering of abdominal radiographs (AXR) in the emergency department (ED) and evaluate the current practices, knowledge and attitudes of emergency physicians with regard to ordering AXRs in patients presenting with acute abdominal pain.	During the study period, 108 patients satisfied the selection criteria, and the AXR was reported as normal in 76 % (n = 82; p value <0.05), non-specific in 12 % (n = 13; p value <0.05) and abnormal in 12 % (n = 13; p value <0.05) of patients. Of those patients, 25 % (n = 27) of the AXRs did not meet indications listed in the Diagnostic Imaging Pathways published by the Western Australia Department of Health and were found not to benefit patient care. Of the 19 doctors who completed the survey, only 16 % (n = 3) were aware of any clinical guidelines for imaging in this setting.	4

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21. van Randen A, Lameris W, Luitse JS, et al. The role of plain radiographs in patients with acute abdominal pain at the ED. <i>Am J Emerg Med.</i> 2011;29(6):582-589 e582.	Observational-Dx	1,021 patients	Prospective multicenter trial to evaluate the added value of plain radiographs on top of clinical assessment in unselected patients presenting with acute abdominal pain at the emergency department.	In 117 of 1,021 patients, the diagnosis changed after plain radiographs, and this change was correct in 39 patients (22% of changed diagnoses and 4% of total study population). Overall, the clinical diagnosis was correct in 502 (49%) patients. The diagnosis after evaluation of the radiographs was correct in 514 (50%) patients, a nonsignificant difference (P=.14). In 65% of patients with unchanged diagnosis before and after plain radiography, the level of confidence of that diagnosis did not change either. The added value of plain radiographs is too limited to advocate their routine use in the diagnostic workup of patients with acute abdominal pain, because few diagnoses change and the level of confidence were mostly not affected.	3
22. Zeina AR, Shapira-Rootman M, Mahamid A, Ashkar J, Abu-Mouch S, Nachtigal A. Role of Plain Abdominal Radiographs in the Evaluation of Patients with Non-Traumatic Abdominal Pain. <i>Isr Med Assoc J.</i> 2015;17(11):678-681.	Observational-Dx	573 patients	To describe the frequency and outcomes of the use of plain abdominal radiographs in the diagnosis of patients presenting with acute non-traumatic abdominal pain in the ED of a medical center.	Of 573 consecutive patients, 300 (52%) underwent abdominal radiography. Findings were normal in 88% (n = 264), non-specific in 7.3% (n = 22), and abnormal in 4.7% (n = 14). For those with normal results, no further imaging was ordered for 43% (114/264). Of the 57% (150/264) who had follow-up imaging, 65% (98/150) showed abnormal findings. In 9 (3%) of the 300 patients, abdominal radiography identified bowel perforations and obstructions, and treatment was provided without the need for further radiologic examination.	4

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23. Antevil JL, Egan JC, Woodbury RO, Rivera L, Oreilly EB, Brown CV. Abdominal computed tomography for postoperative abscess: is it useful during the first week? J Gastrointest Surg. 2006;10(6):901-905.	Observational-Dx	262 CT examinations in 227 patients	Retrospective study to compare the diagnostic utility of CT for suspected intra-abdominal abscess during the first postoperative week with that after day 7.	Of 262 CT examinations (EARLY, n=106; LATE, n=156), 71 studies (27%) demonstrated abscess. There was no significant difference in the diagnostic yield of CT for abscess between EARLY and LATE groups (23% [24/106] vs 30% [47/156], P=0.18). Of patients with an abscess, 63% (45/71) underwent percutaneous or operative drainage (EARLY 75% [18/24], LATE 57% [27/47], P=0.15). Abdominal CT for postoperative abscess can be expected to be diagnostic in a substantial proportion of cases in the first week, the majority of which lead to percutaneous or operative drainage. Postoperative CT for intra-abdominal abscess should be obtained as clinically indicated, regardless of interval from surgery.	3
24. Merlin MA, Shah CN, Shiroff AM. Evidence-based appendicitis: the initial work-up. Postgrad Med. 2010;122(3):189-195.	Review/Other-Dx	N/A	Provide an evidence-based review of appendicitis and appropriate imaging testing. The usefulness of specific diagnostic laboratory tests was also reviewed.	CT has reduced negative appendectomy rates when combined with a physical examination, and assists in ruling out appendicitis. CT scans with no contrast or just rectal contrast are becoming the standard in many institutions. It is essential that when the diagnosis of abdominal pain of unclear etiology is suspected, the clinician's discussion with the patient is well documented on the patient's chart.	4
25. Howell JM, Eddy OL, Lukens TW, et al. Clinical policy: Critical issues in the evaluation and management of emergency department patients with suspected appendicitis. Ann Emerg Med. 55(1):71-116, 2010 Jan.	Review/Other-Dx	N/A	Update of a 2000 clinical policy on the evaluation and management of patients presenting with nontraumatic acute abdominal pain.	Evidence was graded and recommendations were given based on the strength of the available data in the medical literature. US may be used to evaluate children for appendicitis and does not involve ionizing radiation exposure. According to Class II and III evidence, CT is better than US at confirming and excluding appendicitis.	4

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26. Rosen MP, Sands DZ, Longmaid HE, 3rd, Reynolds KF, Wagner M, Raptopoulos V. Impact of abdominal CT on the management of patients presenting to the emergency department with acute abdominal pain. <i>AJR</i> . 2000;174(5):1391-1396.	Observational-Dx	57 patients	Prospective study to document the impact of CT on nontraumatic abdominal pain in the emergency department.	Physician's level of certainty increased by 1.5 points on a 5-point scale. 24% reduction in hospital admissions as a result of CT.	3
27. Lee SY, Coughlin B, Wolfe JM, Polino J, Blank FS, Smithline HA. Prospective comparison of helical CT of the abdomen and pelvis without and with oral contrast in assessing acute abdominal pain in adult Emergency Department patients. <i>Emerg Radiol</i> . 2006;12(4):150-157.	Observational-Dx	118 patients	To compare the agreement of nonenhanced helical computed tomography (NECT) with oral contrast-enhanced computed tomography (CECT) in Emergency Department (ED) patients presenting with acute abdominal pain.	The 118 patients had a mean age of 49 years, a male: female ratio of 7:13, and a median height, weight, and BMI of 166 cm, 80 kg, and 29, respectively. The most common indications for the study included appendicitis (32%) and diverticular disease (12%). Pain maximally localized to the right lower quadrant in 37% and the left lower quadrant in 21%. There were 21 patients that had significant disagreement of interpretations between NECT and CECT resulting in a simple agreement of 79% (95% CI: 70-87%). For specific radiologic parameters, agreement ranged from 77 to 100%. A post hoc agreement analysis was subsequently performed by two radiologists and only five paired scans were identified as discordant between the NECT and CECT. For only one of these patients did both radiologists agree that there was a definite discordant result between the two studies. A final unblinded consensus review demonstrated that much of the disagreement between the interpretations was related to interobserver variation.	2

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28. Razavi SA, Johnson JO, Kassin MT, Applegate KE. The impact of introducing a no oral contrast abdominopelvic CT examination (NOCAPE) pathway on radiology turn around times, emergency department length of stay, and patient safety. <i>Emerg Radiol.</i> 2014;21(6):605-613.	Observational-Dx	6409 CTs	To evaluate the impact of the no oral contrast abdominopelvic CT examination (NOCAPE) on radiology turn around time (TAT), emergency department (ED) length of stay (LOS), and patient safety metrics.	The NOCAPE pathway reduced median order to complete TAT by 32 min (22.9 %) compared to IV and oral contrast AP CT examinations (traditional pathway) (P < 0.001). Median order to final TAT was 2.9 h in NOCAPE patients and 3.5 h in the traditional pathway, a 36-min (17.1 %) reduction (P < 0.001). Overall, the NOCAPE pathway reduced ED LOS by a median of 43 min (8.8 %) compared to the traditional pathway (8.2 vs 7.5 h) (P = 0.003). Recall and bounce back rates were 3.2 %, and only one patient had change in impression after oral contrast CT was repeated.	3
29. Schuur JD, Chu G, Sucov A. Effect of oral contrast for abdominal computed tomography on emergency department length of stay. <i>Emerg Radiol.</i> 2010;17(4):267-273.	Observational-Dx	1806 patients	To determine whether not requiring oral contrast for CT of the abdomen and pelvis (CTAP) reduces ED length of stay (LOS).	Oral contrast usage decreased from 42.5% of CTAP to 12.2% (difference 30.3%, 95% confidence interval 38.7% to 46.3%). There was no change in LOS among all ED visits. Among ED visits where a CTAP was performed, median time to CTAP decreased by 27 min and median LOS decreased by 30 min. Adjusted LOS decreased from 324 min (312-337) to 297 min (285-309).	3
30. Uyeda JW, Yu H, Ramalingam V, Devalapalli AP, Soto JA, Anderson SW. Evaluation of Acute Abdominal Pain in the Emergency Setting Using Computed Tomography Without Oral Contrast in Patients With Body Mass Index Greater Than 25. <i>J Comput Assist Tomogr.</i> 39(5):681-6, 2015 Sep-Oct.	Observational-Dx	1992 patients	To evaluate the rate of delayed or missed diagnoses and need for additional computed tomography (CT) imaging in emergency department patients with abdominal pain who are imaged without oral contrast.	Of the 1992 patients included in this study, 4 patients (0.2%) underwent repeat CT studies directly related to the absence of oral contrast on the original examination. Of the 1992 CT scans, 1193(59.8%) were interpreted as negative, none of which required surgery or direct intervention. In patients with acute appendicitis, there was a sensitivity of CT in this patient population of 100% with a specificity of 99.5%.	3

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31. Abujudeh HH, Kaewlai R, McMahon PM, et al. Abdominopelvic CT increases diagnostic certainty and guides management decisions: a prospective investigation of 584 patients in a large academic medical center. <i>AJR</i> . 2011;196(2):238-243.	Review/Other-Dx	584 patients	To prospectively determine how CT affects physicians' diagnostic certainty and management decisions in the setting of patients with nontraumatic abdominal complaints presenting to the emergency department.	The most common diagnoses were renal colic (119/584, 20.4%) and intestinal obstruction (80/584, 13.7%). CT altered the leading diagnosis in 49% of the patients (284/584, P<0.00001) and increased mean physician diagnostic certainty from 70.5% (pre-CT) to 92.2% (post-CT) (P<0.001; log likelihood ratio, 2.48). The management plan was changed by CT in 42% (244/583) (P<0.0001). Physicians planned to admit 75.3% of the patients (440/584) to the hospital before CT; that plan was changed to hospital discharge with follow-up in 24.1% of patients (106/440) after CT. Surgery was planned for 79 patients before CT, whereas hospital discharge was planned for 25.3% of these patients (20/79) after CT. In the management of patients presenting to the emergency department with nontraumatic abdominal complaints, CT changes the leading diagnosis, increases diagnostic certainty, and changes potential patient management decisions.	4
32. Barkhausen J, Stoblen F, Dominguez-Fernandez E, Henseke P, Muller RD. Impact of CT in patients with sepsis of unknown origin. <i>Acta Radiol</i> . 1999;40(5):552-555.	Observational-Dx	63 consecutive patients; 45 abdominal and 38 chest exams	Evaluate abdominal and chest examinations to determine the diagnostic relevance of CT in patients with sepsis of unknown origin.	CT is useful for the evaluation of patients with fever or sepsis without a known source. Following CT, 19% of patients could be immediately referred for percutaneous drainage or surgery.	3

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33. Fishman EK, Kavuru M, Jones B, et al. Pseudomembranous colitis: CT evaluation of 26 cases. <i>Radiology</i> . 1991;180(1):57-60.	Review/Other-Dx	26 patients	Review CT appearances of patients with pseudomembranous colitis.	23 patients demonstrated an abnormal bowel wall, with an average wall thickness of 14.7 mm (range, 3-32 mm); in 3 patients, bowel wall thickness was normal. Contrast material trapped between thickened folds corresponded to the broad transverse bands described on plain radiographs. Pancolonic involvement was seen in 13 cases, while 7 patients had right-sided involvement only; 3 patients had bowel wall thickening limited to the rectosigmoid only. Although the CT appearance of pseudomembranous colitis is not highly specific, the diagnosis may be suggested in the proper clinical setting. CT appearance of pseudomembranous colitis is not highly specific.	4
34. Kassi F, Dohan A, Soyer P, et al. Predictive factors for failure of percutaneous drainage of postoperative abscess after abdominal surgery. <i>Am J Surg</i> . 207(6):915-21, 2014 Jun.	Observational-Tx	81 patients	To assess the efficacy of percutaneous drainage of postoperative abscess after abdominal surgery and to identify factors predictive of failed drainage.	Successful drainage requiring 1 (n = 46) or 2 (n = 17) procedures was observed in 63 patients (78%; 95% confidence interval, 67%-86%). Surgery was needed in 18 patients (22%; 95% confidence interval, 14%-38%). Residual collection after a first percutaneous drainage was the single predictive factor for failed drainage on univariate and multivariate analyses (P = .0275).	3
35. Siddiki H, Fidler J. MR imaging of the small bowel in Crohn's disease. <i>Eur J Radiol</i> . 2009;69(3):409-417.	Review/Other-Dx	N/A	To review the advantages and limitations of MR for imaging the small bowel, describe technical issues for the performance of MR enterography and enteroclysis and discuss the role and controversies of using MRI in the assessment of IBD.	MRI is well suited for the evaluation of small bowel and is playing an increasing role in the evaluation of many diseases including Crohn's disease. MRI provides anatomic, functional and real-time information without the need for ionizing radiation exposure.	4

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
36. Byott S, Harris I. Rapid acquisition axial and coronal T2 HASTE MR in the evaluation of acute abdominal pain. <i>Eur J Radiol.</i> 85(1):286-90, 2016 Jan.	Observational-Dx	468 cases	To assess T2 HASTE MR in acute abdominal imaging and ascertain if it is a reliable alternative to CT in patients under 60.	468 cases included in the study. 349 were negative for acute abdominal pathology, 116 positive for acute abdominal pathology and 3 were indeterminate. In the MR positive group (n=116), 64 had surgery confirming findings (34 appendicitis, 14 SBO, 3 ovarian torsion, 3 LBO, intussusception, ovarian carcinoma, ovarian dermoid, 2 pelvic inflammatory disease, diverticular abscess, crohns, 4 endoscopy for acute bowel pathology) while 51 were managed conservatively with concordant follow up (4 SBO, 11 diverticulitis, 6 pelvic inflammatory disease, 7 inflammatory bowel disease, 7 colitis, 6 pyelonephritis, 2 cholecystitis, renal abscess, pseudomembranous colitis, splenic haematoma, mesenteric adenitis, 2 pancreatitis, lymphoma, epiploic appendagitis). 1 patient had an MR diagnosis of appendicitis but at laparoscopy a sigmoid diverticular perforation was diagnosed and the appendix was normal. In the MR negative group (n=349), 324 had uneventful follow-up, 22 had negative laparoscopies, while 3 had subsequent appendectomies, with appendicitis on histology (3 days, 10 days and 2 months post scan). In the MR indeterminate group (n=3), one was treated conservatively with uneventful follow up, one had laparoscopic appendectomy with normal appendix on histology, one had laparoscopic appendectomy with acute appendicitis on histology. When MR correlated with clinical follow up (n=468), overall diagnostic accuracy is 99% (463/468). When MR findings correlated with direct visualisation at surgery/endoscopy (n=90), sensitivity is 98% (95% CI) and specificity is 92% (95%	3



**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
				CI).	
37. Singh AK, Desai H, Novelline RA. Emergency MRI of acute pelvic pain: MR protocol with no oral contrast. EMERG. RADIOL.. 16(2):133-41, 2009 Mar.	Observational-Dx	67 patients	To evaluate the efficacy of magnetic resonance (MR) without oral contrast in the assessment of suspected acute pathologies of the pelvis in pregnant and non-pregnant patients.	Positive pelvic MR findings were seen in 73% (49/67). Final diagnoses were acute appendicitis (n = 12), ovarian torsion (n = 6), abscess (n = 3), tubo-ovarian abscess (n = 2), ovarian tumor (n = 2), degenerating fibroid (n = 3), and perianal fistula (n = 2). For acute appendicitis, sensitivity was 100% (12/12), and positive predictive value was 92% (12/13). Post-gadolinium T1-weighted sequences and T2 SS-FSE with FS were the sequences, which were most likely to best demonstrate the acute appendicitis. For ovarian torsion, the sensitivity was 86% (6/7), and positive predictive value was 100% (6/6).	4
38. Oto A, Schmid-Tannwald C, Agrawal G, et al. Diffusion-weighted MR imaging of abdominopelvic abscesses. Emerg Radiol. 2011;18(6):515-524.	Observational-Dx	58 patients	To determine the incremental value of diffusion-weighted MR imaging (DW-MRI) over T2-weighted imaging diagnosing abdominopelvic abscesses and compare apparent diffusion coefficient (ADC) values of abscesses and non-infected ascites.	Detection of abscesses and confidence improved significantly when T2-weighted images were combined with DW-MRI (sensitivity: observer 1-100%, observer 2-96.6%) or contrast enhanced images (sensitivity: both observers-100%) compared to T2-weighted images alone (sensitivity: observer 1-65.5%, observer 2-72.4%). All abscesses showed restricted diffusion. Mean ADC of abscesses (observer 1-1.17 +/- 0.42 x 10 <sup>(-3)</sup> mm <sup>(2)</sup> /s, observer 2-1.43 +/- 0.48 x 10 <sup>(-3)</sup> mm <sup>(2)</sup> /s) was lower than ascites (observer 1-3.57 +/- 0.68 x 10 <sup>(-3)</sup> mm <sup>(2)</sup> /s, observer 2-3.42 +/- 0.67 x 10 <sup>(-3)</sup> mm <sup>(2)</sup> /s) (p < 0.01). ROC analysis showed perfect discrimination of abscess from ascites with threshold ADC of 2.0 x 10 <sup>(-3)</sup> mm <sup>(2)</sup> /s (Az value 1.0).	3

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
39. Dobrin PB, Gully PH, Greenlee HB, et al. Radiologic diagnosis of an intra-abdominal abscess. Do multiple tests help? Arch Surg. 1986;121(1):41-46.	Observational-Dx	94 patients	Review charts of patients to evaluate roles of CT, US and gallium in ruling out intra-abdominal abscesses.	The sensitivities and specificities were as follows: CT (88%, 93%), US (75%, 91%) and gallium scans (73%, 81%). Authors conclude that CT scan was the only test necessary, as additional tests did not add significantly.	4
40. Yitta S, Mausner EV, Kim A, et al. Pelvic ultrasound immediately following MDCT in female patients with abdominal/pelvic pain: is it always necessary? Emerg Radiol. 2011;18(5):371-380.	Observational-Dx	70 patients	To determine the added value of reimaging the female pelvis with ultrasound (US) immediately following multidetector computed tomography (MDCT) in the emergent setting.	Ultrasound changed the diagnosis for the ovaries/adnexa 8.1% of the time (three reader average); the majority being cases of a suspected CT abnormality found to be normal on US. Ultrasound changed the diagnosis for the uterus 11.9% of the time (three reader average); the majority related to the endometrial canal. The 95% confidence intervals for the ovaries/adnexa and uterus were 5-12.5% and 8-17%, respectively. Ten cases of a normal CT were followed by a normal US with 100% agreement across all three readers. Experienced readers correctly diagnosed ruptured ovarian cysts and tubo-ovarian abscesses (TOA) based on CT alone with 100% agreement.	2
41. van Randen A, Lameris W, van Es HW, et al. A comparison of the accuracy of ultrasound and computed tomography in common diagnoses causing acute abdominal pain. Eur Radiol. 2011;21(7):1535-1545.	Observational-Dx	1,021 patients	To report a head-to-head comparison of the accuracy of US and CT in detecting common causes of acute abdominal pain, such as appendicitis and diverticulitis, in patients presenting at the emergency department with acute abdominal pain.	Frequent final diagnoses in the 1,021 patients (mean age 47; 55% female) were appendicitis (284; 28%), diverticulitis (118; 12%) and cholecystitis (52; 5%). The sensitivity of CT in detecting appendicitis and diverticulitis was significantly higher than that of US: 94% vs 76% (P<0.01) and 81% vs 61% (P=0.048), respectively. For cholecystitis, the sensitivity of both was 73% (P=1.00). PPVs did not differ significantly between US and CT for these conditions. US sensitivity in detecting appendicitis and diverticulitis was not significantly negatively affected by patient characteristics or reader experience.	2

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
42. Dibble EH, Yoo DC, Noto RB. Role of PET/CT in Workup of Fever without a Source. <i>Radiographics</i> . 2016;36(4):1166-1177.	Review/Other-Dx	N/A	To discuss the role of imaging in the diagnosis and management of fever without a source with a focus on positron emission tomography (PET)/computed tomography (CT) and to review the imaging appearance of many causes of fever and the imaging costs to a radiology department with a focus on radio-pharmaceutical costs.	No results stated in abstract.	4
43. Baba AA, McKillop JH, Cuthbert GF, Neilson W, Gray HW, Anderson JR. Indium 111 leucocyte scintigraphy in abdominal sepsis. Do the results affect management? <i>Eur J Nucl Med</i> . 1990;16(4-6):307-309.	Observational-Dx	45 patients	Retrospective review of patients presenting with suspected intra-abdominal sepsis to examine the value of 111In-autologous leucocyte scintigraphy.	Sensitivity of 95%, specificity of 91%. 34 of those studies were felt to help patient management by either being positive or negative.	4
44. Goldman M, Ambrose NS, Drolc Z, Hawker RJ, McCollum C. Indium-111-labelled leucocytes in the diagnosis of abdominal abscess. <i>Br J Surg</i> . 1987;74(3):184-186.	Observational-Dx	100 consecutive patients	To evaluate the accuracy of 111In-labelled leucocytes to diagnose abscess. 34 post-surgical, 34 IBD, and 30 miscellaneous patients were studied.	Sensitivity 93%, specificity 100% of the 30 abscesses. 111In-labelled leucocyte imaging provides a rapid, safe and precise method for detecting intra-abdominal abscess even in the presence of IBD.	2
45. Field TC, Pickleman J. Intra-abdominal abscess unassociated with prior operation. <i>Arch Surg</i> . 1985;120(7):821-824	Observational-Dx	65 patients	Evaluate diagnosis of patients treated for intra-abdominal abscesses unassociated with prior operation.	Radiologic tests proved quite accurate in confirming diagnosis. Abdominal radiographs were abnormal in 25/44 patients, as were US in 33 (89%) of 37 patients, CT in 13 (100%) of 13 patients, and gallium scans in 5 (100%) of 5 patients.	4
46. Lantto EH, Lantto TJ, Vorne M. Fast diagnosis of abdominal infections and inflammations with technetium-99m-HMPAO labeled leukocytes. <i>J Nucl Med</i> . 1991;32(11):2029-2034.	Observational-Dx	80 patients; 87 investigations	Prospective study to evaluate diagnostic accuracy of abdominal infections with Tc-99m-HMPAO-leukocyte images (2 minute, 0.5 minutes, 2 hours and 4 hours).	2-minute scans: sensitivity, specificity and accuracy were 74%, 85% and 77%. 0.5-minute scans: sensitivity, specificity and accuracy were 88%, 81% and 86%. 2-hour scans; sensitivity, specificity and accuracy were 5%, 85% and 92%. 4-hour scans: sensitivity, specificity and accuracy were 96%, 92% and 95%. Imaging within 2 hours from injection has a high diagnostic value and activity accumulates in areas of infection and inflammation faster than in the intestinal background.	1

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
47. Nicksa GA, Dring RV, Johnson KH, Sardella WV, Vignati PV, Cohen JL. Anastomotic leaks: what is the best diagnostic imaging study? Dis Colon Rectum. 2007;50(2):197-203.	Observational-Dx	36 patients	Retrospective chart review was performed to evaluate and compare CT scans and water-soluble enemas in detecting lower gastrointestinal anastomotic leaks.	There were 28/36 patients (78 %) re-explored on the basis of a radiologic study demonstrating an anastomotic leak. A total of 27 CT scans were performed, of which 4 (14.8 %) were considered positive for an anastomotic leak. 18 patients were evaluated with a water-soluble enema and 15 (83.3%) demonstrated extravasation of contrast material. In the 26 patients with a distal anastomotic leak, 17 water-soluble enemas were performed, with 15 (88%) demonstrating a leak. In contrast, only 2/17 (12%) CT scans were positive in this group of patients (P<0.001). There were 10 patients who initially had a CT scan followed by a water-soluble enema. Of these patients, 8/9 (88%) initially had a negative CT scan but were considered to be clinically suspicious of having an anastomotic leak and subsequently had a leak demonstrated on a water-soluble enema. Study supported the superiority of water-soluble enema to CT imaging in patients in whom both modalities were used. This difference was most pronounced for distal anastomotic leaks, whereas no radiologic imaging study proved effective in evaluating proximal anastomoses.	3
48. Bingham J, Shawhan R, Parker R, Wigboldy J, Sohn V. Computed tomography scan versus upper gastrointestinal fluoroscopy for diagnosis of staple line leak following bariatric surgery. Am J Surg. 2015;209(5):810-814; discussion 814.	Observational-Dx	629 tests	To independently determine the sensitivity and specificity of UGI with CT scan in the evaluation of staple line leak following bariatric surgery.	Six hundred nineteen radiographic "leak tests" were selectively performed following bariatric procedures at our institution between January 2005 and December 2011. CT was found to have a sensitivity of 95% (95% confidence interval [CI] 81.8 to 99.1) and a specificity of 100% (95% CI 93.1 to 100) in diagnosing postoperative leaks, while UGI demonstrated a sensitivity of 79.4% (95% CI 61.6 to 90.0) and a specificity of 95% (95% CI 85.2 to 98.7).	2

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
49. Doraiswamy A, Rasmussen JJ, Pierce J, Fuller W, Ali MR. The utility of routine postoperative upper GI series following laparoscopic gastric bypass. <i>Surg Endosc.</i> 2007;21(12):2159-2162.	Observational-Dx	516 total patients Normal UGI (n=455), Abnormal UGI not requiring further intervention (n=36), Abnormal UGI requiring further intervention (n=25)	To evaluate the efficacy of routine postoperative UGI studies following laparoscopic Roux-en-Y gastric bypass.	Sensitivity of the UGI for anastomotic leak was low (33%). However, all patients with alimentary limb obstruction (n=3) had UGI evidence of this complication. Of 516 UGI reports, there were 25 (4.8%, Group III) that were abnormal and required some form of intervention ranging from serial imaging (84%) to reoperation (16%). Of the various clinical parameters examined, the patients in Group III demonstrated a significantly higher prevalence of fever (P<0.001), tachycardia (P<0.01), vomiting (P<0.001), and postoperative day 1 leukocytosis (P<0.005). Data suggest that routine UGI after laparoscopic Roux-en-Y gastric bypass has limited utility as it may result in unnecessary intervention based on false-positive results or a delay in treatment based on false-negative results. Authors support selective UGI imaging following laparoscopic Roux-en-Y gastric bypass based on the patient's clinical factors, particularly fever and tachycardia.	3

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
50. Gonzalez R, Sarr MG, Smith CD, et al. Diagnosis and contemporary management of anastomotic leaks after gastric bypass for obesity. J Am Coll Surg. 2007;204(1):47-55.	Observational-Dx	3,018 consecutive patients	Multicenter study with prospective collection of data. To review and document the spectrum of clinical presentation, the use and efficacy of diagnostic tests, and outcomes of treatment in patients who developed anastomotic leaks after undergoing Roux-en-Y gastric bypass for clinically significant obesity.	UGI series and CT demonstrated leaks in 17/56 (30%) and 28/50 (56%) patients, respectively; when done jointly, both studies were negative in 30% of patients. Nonoperative treatment was successful in 23/26 patients, with an overall morbidity of 61% and no mortality (P=NS vs operative). Operative treatment was more common in patients with hypotension or oliguria (P<0.01). Lack of specificity in clinical presentation and imaging studies make diagnosing anastomotic leaks challenging, so operative exploration should be part of the diagnostic algorithm. Nonoperative treatment is safe and effective in a subset of patients who exhibit stable hemodynamic parameters and are known to have controlled leaks.	3
51. Madan AK, Stoecklein HH, Ternovits CA, Tichansky DS, Phillips JC. Predictive value of upper gastrointestinal studies versus clinical signs for gastrointestinal leaks after laparoscopic gastric bypass. Surg Endosc 2007; 21(2):194-196.	Observational-Dx	245 patients	Retrospective study. To examine the hypothesis that UGI studies are more predictive than clinical signs for the early diagnosis of a postoperative leak after laparoscopic Roux-en-Y gastric bypass.	The PPV and NPV of UGI studies were 67% and 99%, respectively. Only an elevated white blood count had a better predictive value (100% for NPV). The efficiency of UGI studies (98%) was better than that of heart rate (83%), white blood count (8%), or temperature (95%). According to the authors' data, UGI studies are the most predictive of an early leak diagnosis. Clinical signs alone may not be as useful in predicting leaks early after laparoscopic gastric bypasses. Routine early postoperative UGI studies are a reasonable approach to predicting leaks after laparoscopic Roux-en-Y gastric bypass.	3

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
52. Sarkissian H, Hyman N, Osler T. Postoperative fluid collections after colon resection: the utility of clinical assessment. <i>Am J Surg.</i> 206(4):551-4, 2013 Oct.	Observational-Dx	906 patients	To determine which clinical and radiologic criteria best predict the probability that a postoperative collection will ultimately be considered to represent an abscess.	Nine hundred six patients had a colon resection during the study period. Fifty-four patients had a postoperative fluid collection, of which 36 were found to be abscesses. Only high clinical suspicion of an abscess predicted the presence of an abscess (P = .009); of the radiologic criteria, only proximity to the anastomosis was predictive (P = .05).	3
53. Behrman SW, Zarzaur BL. Intra-abdominal sepsis following pancreatic resection: incidence, risk factors, diagnosis, microbiology, management, and outcome. <i>Am Surg.</i> 2008;74(7):572-578; discussion 578-579.	Observational-Tx	196 patients	To retrospectively review patients developing IAS following elective pancreatectomy.	Eleven of 32 (34%) of these infections were diagnosed on or before postoperative day 6, 10 of who had Whipple procedures. Statistically significant risk factors included an overt pancreatic fistula (18.8% vs 5.5%) and a soft pancreatic remnant (74.2% vs 42.3%), but not the lack of intra-abdominal drainage, an antecedent immunocompromised state, postoperative hemorrhage, or the preoperative placement of a biliary stent. Fifty-five per cent had polymicrobial infections and 26 per cent of isolates were resistant organisms. Nineteen per cent and 48 per cent of patients had an isolate positive for fungus and a Gram-positive organism, respectively. Forty-seven therapeutic interventions were used, including 10 reoperations. Length of stay was significantly prolonged in those with IAS (28.5 vs 15.2 days) and mortality was higher (15.6% vs 1.8%).	3
54. Kamaya A, Federle MP, Desser TS. Imaging manifestations of abdominal fat necrosis and its mimics. <i>Radiographics.</i> 2011;31(7):2021-2034.	Review/Other-Dx	N/A	To discuss the myriad appearances of fat necrosis in the abdomen and its mimics.	No results stated in abstract.	4

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
55. Lundstedt C, Hederstrom E, Brismar J, Holmin T, Strand SE. Prospective investigation of radiologic methods in the diagnosis of intra-abdominal abscesses. <i>Acta Radiol Diagn (Stockh)</i> . 1986;27(1):49-54.	Observational-Dx	40 patients	Prospective study to evaluate the use various imaging tests (conventional abdominal radiography, US, CT and 111In-labelled leucocyte scintigraphy) in the evaluation of intra-abdominal abscesses. All patients (40) had all tests.	Sensitivities and specificities as follows: Radiographs (45%, 95%), scintigraphy (65%, 55%), US (82%, 78%), CT (78%, 85%). CT was the single most reliable test but the combination of US and 111In-labelled leucocyte scintigraphy show all lesions.	3
56. Kirkpatrick ID, Greenberg HM. Gastrointestinal complications in the neutropenic patient: characterization and differentiation with abdominal CT. <i>Radiology</i> . 2003;226(3):668-674.	Observational-Dx	76 patients	Retrospective review to characterize CT findings of gastrointestinal complications of neutropenic patients and identify CT features that can differentiate these complications.	CT findings such as bowel wall thickness, pneumatosis, wall nodularity and mucosal enhancement can be used to differentiate the complications in neutropenic patients.	2
57. Hordonneau C, Montoriol PF, Guieze R, Garcier JM, Da Ines D. Abdominal complications following neutropenia and haematopoietic stem cell transplantation: CT findings. <i>Clin Radiol</i> . 2013;68(6):620-626.	Review/Other-Dx	N/A	To provide the spectrum of specific diagnoses encountered and the corresponding key CT features in patients presenting with acute abdominal disorders following neutropenia and/or haematopoietic stem cell transplantation.	No results stated in abstract.	4
58. Hammond NA, Miller FH, Yaghmai V, Grundhoefer D, Nikolaidis P. MR imaging of acute bowel pathology: a pictorial review. <i>Emerg Radiol</i> . 2008;15(2):99-104.	Review/Other-Dx	N/A	Pictorial essay to describe MRI features of acute processes involving the bowel.	While CT is likely to remain the modality of choice, the advantages of MRI include high soft-tissue contrast, lack of ionizing radiation, and the ability to administer gadolinium in patients with a history of allergic reaction to iodinated contrast material. With the increasing utilization of abdominal/pelvic MR, radiologists must recognize the MR features of acute bowel pathology. Key MR findings of a variety of causes of acute abdominal pain are illustrated.	4
59. Bernabeu-Wittel M, Villanueva JL, Pachon J, et al. Etiology, clinical features and outcome of splenic microabscesses in HIV-infected patients with prolonged fever. <i>Eur J Clin Microbiol Infect Dis</i> . 1999;18(5):324-329.	Observational-Dx	32 consecutive patients	Prospective study to determine the etiology and clinical features and outcome of HIV-infected patients with prolonged fever and multiple splenic microabscesses in which high resolution (7.5 MHz) US revealed multiple splenic microabscesses.	Splenic microabscesses may be a frequent condition in HIV-infected patients with prolonged fever. High-resolution US is a useful technique for their detection and follow-up.	2



**Acute Nonlocalized Abdominal Pain  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
<p>60. Lameris W, van Randen A, van Es HW, et al. Imaging strategies for detection of urgent conditions in patients with acute abdominal pain: diagnostic accuracy study. <i>BMJ</i>. 2009;338:b2431.</p>	<p>Observational-Dx</p>	<p>1,021 patients</p>	<p>Multicentre diagnostic accuracy study with prospective data collection to identify an optimal imaging strategy for the accurate detection of urgent conditions in patients with acute abdominal pain.</p>	<p>661 (65%) patients had a final diagnosis classified as urgent. The initial clinical diagnosis resulted in many false positive urgent diagnoses, which were significantly reduced after US or CT. CT detected more urgent diagnoses than did US: sensitivity was 89% (95% CI, 87% to 92%) for CT and 70% (67% to 74%) for US (P&lt;0.001). A conditional strategy with CT only after negative or inconclusive US yielded the highest sensitivity, missing only 6% of urgent cases. With this strategy, only 49% (46% to 52%) of patients would have CT. Alternative strategies guided by body mass index, age, or location of the pain would all result in a loss of sensitivity. Although CT is the most sensitive imaging investigation for detecting urgent conditions in patients with abdominal pain, using US first and CT only in those with negative or inconclusive US results in the best sensitivity and lowers exposure to radiation.</p>	<p>3</p>

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
61. Jaffe TA, Martin LC, Miller CM, et al. Abdominal pain: coronal reformations from isotropic voxels with 16-section CT--reader lesion detection and interpretation time. Radiology. 2007;242(1):175-181.	Review/Other-Dx	29 consecutive patients; 8 independent readers reviewed randomized scans	To retrospectively assess if reader detection of intra-abdominal pathologic findings on coronal reformations from isotropic voxels at 16-section CT was similar to reader detection on transverse scans.	Agreement was moderate to near perfect between transverse and coronal interpretations for intra-abdominal anatomic and pathologic findings ( $\kappa=0.59-1.00$ ). For transverse interpretations, more thoracic pathologic findings were noted than for coronal interpretations; for coronal interpretations, more lymph nodes were noted than for transverse interpretations. Mean transverse interpretation time was 4.9 minutes $\pm$ 1.1 (standard deviation) (range, 2.9-6.5 minutes); mean coronal interpretation time was 5.1 minutes $\pm$ 0.8 (range, 3.3-6.7 minutes). For each reader, there was no statistically significant difference in interpretation time between transverse and coronal scans ( $P=.06$ ). With regard to the presence of intra-abdominal pathologic findings, coronal reformations from isotropic voxels are similar to transverse scans in terms of interpretation time and reader agreement.	4

Acute Nonlocalized Abdominal Pain  
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
<p>62. Yaghmai V, Nikolaidis P, Hammond NA, Petrovic B, Gore RM, Miller FH. Multidetector-row computed tomography diagnosis of small bowel obstruction: can coronal reformations replace axial images? Emerg Radiol. 2006;13(2):69-72.</p>	<p>Review/Other-Dx</p>	<p>67 patients 34 had surgically proven SBO</p>	<p>To evaluate the feasibility of diagnosing SBO on MDCT using coronal reformations alone.</p>	<p>33 (100%) of 33 patients were correctly diagnosed not to have intestinal obstruction on coronal images. 34 (100%) of 34 patients were correctly diagnosed to have SBO on both forms of image display. There were 5 patients where the final surgical diagnosis for the etiology of SBO did not agree with the interpretation of either the coronal or axial images; however, in all 5 patients, the interpretations of axial and coronal images were similar. In only one patient, the etiology of SBO based on the coronal images did not agree with that of axial images and the surgical result; however, the site of SBO was correctly diagnosed. There were approximately 20% fewer images in the coronal reformation data set, and the radiologists found review of these images to be easier for localizing the zone of transition in SBO. Very high diagnostic accuracy can be achieved based on coronal reformations alone, and this form of image display may potentially be substituted for the conventional axial images. Since there are fewer images to review when the studies are displayed in coronal plane, this may positively impact radiologist workflow.</p>	<p>4</p>

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
63. Zangos S, Steenburg SD, Phillips KD, et al. Acute abdomen: Added diagnostic value of coronal reformations with 64-slice multidetector row computed tomography. <i>Acad Radiol.</i> 2007;14(1):19-27.	Observational-Dx	100 consecutive patients; 4 independent blinded readers	To retrospectively assess the added value of coronal reformations from isotropic voxels obtained with 64-slice MDCT of the acute abdomen.	92 patients received intravenous contrast and 90 patients received oral contrast. In 45 patients, no CT abnormalities were detected for an explanation of the abdominal pain. Mean sensitivity and specificity of axial CT alone were 92.5% and 91%, respectively. No significant differences in sensitivity and specificity were observed for the use of combined axial and coronal images. For the most inexperienced reader, the coronal reformations were helpful in 95% of cases, while for the most experienced reader, the coronal reformations were helpful in 35% of the cases. The coronal images were deemed helpful in an average of 62.3% of the cases for the 4 readers. However, diagnosing subtle pathology in the abdominal wall was difficult on coronal reformations alone. Overall, coronal reformations improved diagnostic confidence and interobserver agreement over axial images alone for visualization of normal abdominal structures and in the diagnosis of abdominal pathology.	2
64. Coursey CA, Nelson RC, Patel MB, et al. Making the diagnosis of acute appendicitis: do more preoperative CT scans mean fewer negative appendectomies? A 10-year study. <i>Radiology.</i> 254(2):460-8, 2010 Feb.	Observational-Dx	925 patients: 526 men, 399 women	To determine the frequency of preoperative CT in the evaluation of patients suspected of having appendicitis at one institution during the past 10 years and to determine whether changes in CT utilization were associated with changes in the negative appendectomy rate.	Prior to urgent appendectomy, 18.5% of patients underwent preoperative CT in 1998 compared with 93.2% of patients in 2007. The negative appendectomy rate for women $\geq$ 45 years of age decreased from 42.9% in 1998 to 7.1% in 2007. However, the timing of the decline in negative appendectomy rates for women $\geq$ 45 years of age could not be proved to be associated with the increase in CT use. There was no significant trend toward a lower negative appendectomy rate for men regardless of age or for women older than 45 years of age with increased use of preoperative CT.	3

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
65. Krajewski S, Brown J, Phang PT, Raval M, Brown CJ. Impact of computed tomography of the abdomen on clinical outcomes in patients with acute right lower quadrant pain: a meta-analysis. <i>Can J Surg</i> . 2011;54(1):43-53.	Meta-analysis	28 articles	To evaluate the impact of abdominal CT on the clinical outcomes of patients presenting with suspected appendicitis.	The negative appendectomy rate was 8.7% when using CT compared with 16.7% when using clinical evaluation alone ( $P<0.001$ ). There was also a significantly lower negative appendectomy rate during the CT era compared with the pre-CT era (10.0% vs 21.5%, $P<0.001$ ). Time to surgery was evaluated in 10 of the 28 studies, 5 of which demonstrated a significant increase in the time to surgery with the use of CT. Appendiceal perforation rates were unchanged by the use of CT (23.4% in the CT group vs 16.7% in the clinical evaluation group, $P=0.15$ ). Similarly, the perforation rate during the CT era was not significantly different than that during the pre-CT era (20.0% vs 19.6%, $P=0.74$ ).	Good
66. Ng CS, Palmer CR. Assessing diagnostic confidence: a comparative review of analytical methods. <i>Acad Radiol</i> . 2008;15(5):584-592.	Observational-Dx	62 patients	To assess the principles underlying the different analytic methods for assessing diagnostic confidence and to compare the methods using data from an illustrative case study. The approaches compared were “basic,” “retained diagnoses,” “Omary,” “Tsushima,” and “score-based” methods.	In the case study, mean diagnostic confidence for the cohort as a whole ( $n=62$ ) increased following CT: 50.7% (20.8%) to 73.2% (20.9%). Pretest diagnoses were changed following CT in 43% (27/62) of patients. Pretest diagnoses proved to be incorrect in 52% (32/62), and post-test diagnoses incorrect in as many as 19% (12/62) of patients. All 5 analytic methods indicated a positive contribution for CT (all $P=.003$ ). Although illustrative case study revealed no consequential differences across the 5 methods, there remain substantial differences in the fundamental principles underlying them that should affect choice of analytic method when assessing diagnostic confidence.	3

Acute Nonlocalized Abdominal Pain  
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
<p>67. Stromberg C, Johansson G, Adolfsson A. Acute abdominal pain: diagnostic impact of immediate CT scanning. <i>World J Surg.</i> 31(12):2347-54; discussion 2355-8, 2007 Dec.</p>	<p>Observational-Dx</p>	<p>2,222 patients</p>	<p>To retrospectively evaluate the routine use of contrast enhanced CT scanning early in the diagnostic process.</p>	<p>After CT, the following diagnoses were suggested as the primary cause of the abdominal pain: nonspecific abdominal pain 984 (44.3%), appendicitis 354 (15.9%), bowel obstruction 190 (8.6%), diverticulitis 182 (8.2%), gastrointestinal perforation 52 (2.3%), gallstone disease 64 (2.9%), pancreatitis 72 (3.2%), IBD 13 (0.6%), intra-abdominal malignancy 34 (1.5%), vascular disease (including 1 completely cured patient with paradoxical embolization in the superior mesenteric artery) 33 (1.5%), urological 131 (5.9%), gynecological 54 (2.4%), miscellaneous 31 (1.4%). In 28 cases a conclusive CT examination could not be carried out. The suggested diagnoses were correct in 2,151 cases (96.8%). In 16 cases (0.7%) an incorrect diagnosis was reported, leading to 7 unnecessary laparotomies. False negative reports were obtained in 27 cases (1.2%). After CT examination 500 patients could be discharged immediately. Contrast-enhanced CT scanning results in superior diagnostic precision in patients with acute abdominal pain. The study supports the strategy to include this examination early in the routine diagnostic process.</p>	<p>3</p>

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
68. Barksdale AN, Hackman JL, Gaddis M, Gratton MC. Diagnosis and disposition are changed when board-certified emergency physicians use CT for non-traumatic abdominal pain. <i>Am J Emerg Med.</i> 33(11):1646-50, 2015 Nov.	Observational-Dx	547 patients	To determine the effect of abdominal computed tomographic (CT) scan results on diagnosis and disposition of patients with non-traumatic abdominal pain who were evaluated by board-certified emergency physicians (EPs).	Six hundred twenty-nine patients were entered and 547 remained after exclusions; 298 (54%) subjects had a change in diagnosis. In 6 categories, there was a statistically significant change, with non-specific abdominal pain the most common ( $P < .001$ ); followed by renal colic ( $P < .001$ ), appendicitis ( $P < .001$ ), diverticulitis ( $P < .001$ ), small bowel obstruction ( $P < .029$ ), and gynecologic process ( $P < .001$ ). The most common disposition plan was "admit for observation," which was reported in 262 patients and remained in only 122 post CT (47%); 301 (54%) patients whose initial plan was admission were ultimately managed otherwise.	2
69. Siewert B, Raptopoulos V, Mueller MF, Rosen MP, Steer M. Impact of CT on diagnosis and management of acute abdomen in patients initially treated without surgery. <i>AJR.</i> 1997;168(1):173-178.	Observational-Dx	91 patients	Retrospective analysis of clinical data and CT reports to evaluate the effect of CT on the diagnosis and management of acute abdominal pain in patients who did not undergo surgery and to determine what population of patients would profit most from CT examination.	CT had sensitivity 90% vs 76% for clinical evaluation alone. Management was changed after CT in 25 patients. CT is recommended for patients with acute abdomen, regardless of the duration of signs and symptoms.	3
70. Taourel P, Baron MP, Pradel J, Fabre JM, Seneterre E, Bruel JM. Acute abdomen of unknown origin: impact of CT on diagnosis and management. <i>Gastrointest Radiol.</i> 1992;17(4):287-291.	Observational-Dx	40 patients	Prospective study to determine the impact of CT on diagnosis and management of patients with acute abdominal pain.	CT scan made the syndrome's diagnosis in 95% of cases and it permitted the detection of a lesion in 57.5% of cases.	3

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
71. Patterson BW, Venkatesh AK, AlKhwam L, Pang PS. Abdominal Computed Tomography Utilization and 30-day Revisitation in Emergency Department Patients Presenting With Abdominal Pain. <i>Acad Emerg Med.</i> 2015;22(7):803-810.	Observational-Dx	3928 patients	To explore which patient characteristics are associated with repeat emergency department (ED) visitation within 30 days of ED discharge for patients presenting with abdominal pain.	Of 80,619 total ED patient visits during the study period, 3,928 ED discharges with a chief complaint of abdominal pain were included. A total of 487 (12.4%) patients revisited the ED within 30 days. No deaths were recorded. CT imaging was associated with a lower 30-day revisit rate (odds ratio [OR] = 0.69, 95% confidence interval [CI] = 0.55 to 0.87) after controlling for multiple other patient-level factors associated with revisits. Increasing age (OR = 1.01, 95% CI = 1.00 to 1.02), increasing triage pain scores (OR = 1.13, 95% CI = 1.08 to 1.18), elevated triage heart rate (OR = 1.42, 95% CI = 1.07 to 1.89), low sodium levels (OR = 1.56, 95% CI = 1.07 to 2.23), and anemia (OR = 1.42, 95% CI = 1.04 to 1.95) were all associated with increased rate of return.	4
72. Scheinfeld MH, Mahadevia S, Stein EG, Freeman K, Rozenblit AM. Can lab data be used to reduce abdominal computed tomography (CT) usage in young adults presenting to the emergency department with nontraumatic abdominal pain? <i>Emerg Radiol.</i> 2010;17(5):353-360.	Observational-Dx	522 patients	To determine whether laboratory parameters could be found, predictive of a negative abdominal CT scan in young adults with nontraumatic abdominal pain.	45% of 522 patients had a cause for pain demonstrated by CT. Predictors of a negative CT in men were normal hematocrit and negative urine blood (P=0.045, P=0.016, respectively), and in women normal hematocrit, granulocyte percent, and alkaline phosphatase (P=0.023, P=0.039, P<0.0001, respectively). When standard normal values were used to calculate descriptive statistics, only granulocyte percent in women had a significant CI (odds ratio 2.5, CI 1.6-4.0). Among the 208 women with normal granulocyte percent, the final clinical diagnosis was appendicitis, cholecystitis, and diverticulitis, in three, three, and two cases, respectively (4% combined). In summary, no laboratory test was sufficient to offer reassurance that a CT is not necessary in a young adult patient with nontraumatic abdominal pain.	3



**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
73. Millet I, Alili C, Bouic-Pages E, Curros-Doyon F, Nagot N, Taourel P. Journal club: Acute abdominal pain in elderly patients: effect of radiologist awareness of clinicobiologic information on CT accuracy. <i>AJR Am J Roentgenol.</i> 2013;201(6):1171-1178; quiz 1179.	Observational-Dx	333 patients	To assess whether the availability of clinicobiologic findings would affect the diagnostic performance of CT of elderly emergency department patients with nontraumatic acute abdominal pain.	In both the entire cohort (87.4% vs 85.3%, $p = 0.07$ ) and the surgical group (94% vs 91%, $p = 0.15$ ), there was no significant difference in CT accuracy between diagnoses made when the radiologist was aware and those made when the radiologist was not aware of the clinicobiologic findings. Agreement between the CT diagnosis and the final diagnosis was excellent whether or not the radiologist was aware of the clinicobiologic findings.	2
74. Kim HC, Yang DM, Kim SW, Park SJ. Gastrointestinal tract perforation: evaluation of MDCT according to perforation site and elapsed time. <i>Eur Radiol.</i> 2014;24(6):1386-1393.	Observational-Dx	168 patients	To evaluate multidetector computed tomography (MDCT) for the prediction of perforation site according to each gastrointestinal (GI) tract site and elapsed time.	The overall diagnostic accuracy was 91.07% and 91.67% for reviewers 1 and 2, respectively, with excellent agreement (kappa 0.86). Accuracies (98.97% and 97.94%) and agreements (kappa 0.894) for stomach and duodenum perforation were higher than for other perforation sites. Strong predictors of perforation at each site were: focal bowel wall discontinuity for stomach, duodenal bulb and left colon, mottled extraluminal air bubbles for retroperitoneal duodenum and right colon, and segmental bowel wall thickening for small bowel. The diagnostic accuracy was not different between the early- and late-lapse groups.	3
75. Karkkainen JM, Lehtimäki TT, Manninen H, Paajanen H. Acute Mesenteric Ischemia Is a More Common Cause than Expected of Acute Abdomen in the Elderly. <i>J Gastrointest Surg.</i> 19(8):1407-14, 2015 Aug.	Review/Other-Dx	N/A	To utilize acute appendicitis, ruptured abdominal aortic aneurysm, acute pancreatitis, and acute cholecystitis as reference diagnoses, and the age-specific incidence rates were calculated.	The in-hospital incidence rates of AMI, acute obstructive mesenteric ischemia, and non-obstructive mesenteric ischemia were 7.3, 4.5, and 2.0/100,000/year, respectively. AMI was more common than ruptured abdominal aortic aneurysm, and the age-specific incidence of AMI was higher than the incidence of acute appendicitis in patients over age 75 years with acute abdomen. During the follow-up, the age-adjusted risk of death was 1.8 times higher in AMI survivors than in survivors of acute cholecystitis.	4

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
76. Reginelli A, Russo A, Pinto A, et al. The role of computed tomography in the preoperative assessment of gastrointestinal causes of acute abdomen in elderly patients. <i>Int J Surg.</i> 12 Suppl 2:S181-6, 2014.	Observational-Dx	126 patients	To assess the diagnostic performance of CT gastrointestinal emergency of elderly patients with nontraumatic acute abdominal pain.	In both the entire cohort (87.5% vs 85.3%, $p = 0.07$ ) and the surgical group (94% vs 91%, $p = 0.15$ ), there was no significant difference in CT accuracy between diagnoses made by the radiologist. Agreement between the CT diagnosis and the final diagnosis was excellent. In the care of elderly patients, CT is accurate for diagnosing the cause of acute abdominal pain, particularly when it is of gastrointestinal surgical origin.	3
77. Sheedy SP, Earnest F 4th, Fletcher JG, Fidler JL, Hoskin TL. CT of small-bowel ischemia associated with obstruction in emergency department patients: diagnostic performance evaluation. <i>Radiology.</i> 241(3):729-36, 2006 Dec.	Observational-Dx	60 patients; 2 reviewers	Retrospective study to evaluate the diagnostic performance of CT for detection of ischemic complications of SBO in emergency department patients and compare prospective interpretation with retrospective interpretation using surgical or pathologic findings as the reference standard.	Sensitivity and specificity for the diagnosis of ischemia were, respectively, 14.8% and 94.1% for prospective interpretations, 29.6% and 91.2% for reader 1, 40.7% and 85.3% for reader 2, and 51.9% and 88.2% for the consensus review. Decreased segmental enhancement was the most specific sign for small-bowel ischemia. Diagnostic performance assessment of CT for diagnosis of ischemic complication of SBO revealed poor prospective interpretation sensitivity.	3
78. American College of Radiology. ACR Appropriateness Criteria®: Imaging of Mesenteric Ischemia. Available at: <a href="https://acsearch.acr.org/docs/70909/Narrative/">https://acsearch.acr.org/docs/70909/Narrative/</a> .	Review/Other-Dx	N/A	Evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for a specific clinical condition.	N/A	4
79. Lehtimäki T, Juvonen P, Valtonen H, Miettinen P, Paajanen H, Vanninen R. Impact of routine contrast-enhanced CT on costs and use of hospital resources in patients with acute abdomen. Results of a randomised clinical trial. <i>Eur Radiol.</i> 2013;23(9):2538-2545.	Experimental-Dx	254 patients	To evaluate the costs of treatment and use of hospital resources when comparing routine abdominal CT and selective imaging practice based on clinical assessment in patients with acute abdomen.	Total treatment cost per patient was 1,202 euros (<euro>) higher in the CT group compared to the SIP group ( $P = 0.002$ ). The length of hospital stay was 1.2 days longer in the CT group (3.7 vs. 2.5 days, $P = 0.010$ ). Routine CT had no impact on ED discharge times. Imaging costs accounted for approximately 10 % of total costs.	3

**Acute Nonlocalized Abdominal Pain  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
<p>80. Broder JS, Hollingsworth CL, Miller CM, Meyer JL, Paulson EK. Prospective double-blinded study of abdominal-pelvic computed tomography guided by the region of tenderness: estimation of detection of acute pathology and radiation exposure reduction. <i>Ann Emerg Med.</i> 2010;56(2):126-134.</p>	<p>Observational-Dx</p>	<p>102 subjects enrolled; 93 with complete data for analysis</p>	<p>Prospective double-blinded observational study. Authors hypothesized that in the emergency department patient with nontraumatic abdominal tenderness, the tender region accurately predicts the location of acute pathology detected on CT.</p>	<p>51 subjects had acute pathology on CT. CT limited to the tender region would reduce z axis (radiation exposure) by 69% (95% CI, 60% to 78%). All acute pathology was included within these boundaries in 17/51 abnormal cases (33%; 95% CI, 22% to 47%). CT from the cephalad marker through the caudad abdomen and pelvis would reduce z axis (radiation exposure) by 38% (95% CI, 29% to 48%). All acute pathology was included within these boundaries in 36/51 abnormal cases (71%; 95% CI, 57% to 81%). With both strategies 1 and 2, the pathologic region was at least partially included within the CT region in the majority of cases (84% and 92%, respectively). CT with z axis restriction based on abdominal tenderness could reduce radiation exposure but with a potentially unacceptably high rate of misdiagnosis, using current methods. Further prospective study may be warranted to determine the diagnostic utility of partially visualized pathology.</p>	<p>2</p>

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
81. Nojkov B, Duffy MC, Cappell MS. Utility of repeated abdominal CT scans after prior negative CT scans in patients presenting to ER with nontraumatic abdominal pain. Dig Dis Sci. 58(4):1074-83, 2013 Apr.	Observational-Dx	200 patients	To analyze diagnostic yield of repeat computed tomography (CT) after negative initial CT versus yield of initial CT in patients presenting repeatedly to emergency room (ER) for nontraumatic abdominal pain.	Among 200 consecutive patients undergoing (659) multiple CTs (mean age = 45.7 years, 74 % female), positivity rate for initial CT (22.5 %) was significantly higher than positivity rates for CT#2 (8.4 %, p = 0.002), for CT#3 (4.9 %, p = 0.005), and for CT >= #4 (5.9 %, p = 0.006). Generally, CT positivity rate declined with increasing number of prior negative CTs. CT positivity rate was significantly higher in 100 patients undergoing single CT versus 155 patients undergoing repeat CTs (46.5 vs. 6.5 %, p = 0.0001). Positive repeat CT findings included intestinal mural thickening/mass (7), colitis (5), appendicitis (4), and other (14). Among 15 analyzed clinical parameters, two significantly predicted repeat CT positivity, namely, leukocytosis (p = 0.03) and APACHE-II-score >5 (p = 0.01). Repeat CTs constituted 47 % of all CTs.	3
82. Aisenberg GM, Grimes RM. Computed tomography in patients with abdominal pain and diarrhoea: does the benefit outweigh the drawbacks? Intern Med J. 2013;43(10):1141-1144.	Observational-Dx	574 scans	To determine whether the use of abdominal CT caused major changes in the management of patients who had abdominal pain and diarrhoea.	Among 124 scans in patients with diarrhoea and 450 scans in patients without diarrhoea, the scan results changed management in 13 of the patients with diarrhoea (11%) and in 233 of those without diarrhoea (52%) (P < 0.001). When management changed, the changes resulted from findings unrelated to diarrhoea.	4

Acute Nonlocalized Abdominal Pain  
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
83. Ham H, McInnes MD, Woo M, Lemonde S. Negative predictive value of intravenous contrast-enhanced CT of the abdomen for patients presenting to the emergency department with undifferentiated upper abdominal pain. <i>Emerg Radiol.</i> 2012;19(1):19-26.	Observational-Dx	127 patients	To calculate the negative predictive value (NPV) CT of the abdomen in patients presenting to the emergency department (ED) with undifferentiated upper abdominal pain.	The NPV was 64% (95% CI 55-72). The FN group had a higher proportion of patients with epigastric pain (p = 0.02) and a lower proportion of patients with left upper quadrant pain (p = 0.02). The WBC, lipase, and ALT were all higher in the FN group compared with the TN group. The most commonly missed pathologies were inflammatory conditions of the biliary tract and upper gastrointestinal systems. The NPV of CT for evaluation of undifferentiated upper abdominal pain in the ED was low at 64%	4
84. Heverhagen JT, Klose KJ. MR imaging for acute lower abdominal and pelvic pain. <i>Radiographics.</i> 2009;29(6):1781-1796.	Review/Other-Dx	N/A	To review MRI protocol that can be used in patients with acute lower abdominal and pelvic pain to establish a fast and reliable diagnosis. Also, various MRI techniques that may be applied in patients presenting with lower abdominal and pelvic pain are described, and the main acute conditions occurring in these patients are presented.	Although ACR Appropriateness Criteria® still rate MRI below CT and US for the evaluation of acute abdominal and pelvic conditions, MRI is an excellent alternative to CT in patients in whom the use of iodinated contrast agents or radiation is not desirable. In addition, when US findings are nondiagnostic or equivocal, MRI is an appropriate modality for the evaluation of acute lower abdominal and pelvic pain, especially in pregnant patients or younger patients.	4
85. Heverhagen JT, Sitter H, Zielke A, Klose KJ. Prospective evaluation of the value of magnetic resonance imaging in suspected acute sigmoid diverticulitis. <i>Dis Colon Rectum.</i> 2008;51(12):1810-1815.	Observational-Dx	55 patients, 2 blinded assessors	To prospectively examine patients with suspected ACD and to provide sensitivity, specificity, and interobserver agreement in a blinded trial.	The two assessors exhibited sensitivities of more than 94%, specificities of 88%, positive likelihood ratios of >7.5, and negative likelihood ratios of <0.07. The kappa coefficient showed a significant, strong correlation between both assessors (kappa = 0.68). MRI is investigator independent and provides high sensitivity and specificity for the diagnosis of ACD.	1
86. Pedrosa I, Levine D, Eyvazzadeh AD, Siewert B, Ngo L, Rofsky NM. MR imaging evaluation of acute appendicitis in pregnancy. <i>Radiology.</i> 2006;238(3):891-899.	Observational-Dx	51 patients	To determine accuracy of MRI in pregnant patients with non-visualization of the appendix with US.	MRI 100% accurate and 94% specific. Only 4 patients had appendicitis.	3

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
87. Singh A, Danrad R, Hahn PF, Blake MA, Mueller PR, Novelline RA. MR imaging of the acute abdomen and pelvis: acute appendicitis and beyond. <i>Radiographics</i> . 2007;27(5):1419-1431.	Review/Other-Dx	N/A	Discussion on the advantages and disadvantages of MRI for acute abdomen and pelvic pain and beyond.	MRI is an attractive modality for diagnostic imaging in patients for whom the risks of radiation or the potential nephrotoxicity of iodinated contrast agents is a major concern, such as pregnant and pediatric patients. MRI is most useful for evaluating pregnant patients with acute lower abdominal pain believed to have an extra-uterine cause, such as appendicitis or ovarian torsion. Other patients with other conditions commonly seen in the emergency setting may be better evaluated with another cross-sectional imaging modality.	4
88. Lubarsky M, Kalb B, Sharma P, Keim SM, Martin DR. MR imaging for acute nontraumatic abdominopelvic pain: rationale and practical considerations. <i>Radiographics</i> . 33(2):313-37, 2013 Mar-Apr.	Review/Other-Dx	N/A	To discuss emergency department MR imaging for abdominopelvic indications in terms of rationale, imaging techniques, clinical applications, evolving indications, and limitations.	No results stated in abstract.	4
89. Mkpolulu CA, Ghobrial PM, Catanzano TM. Nontraumatic abdominal pain in pregnancy: imaging considerations for a multiorgan system problem. <i>Semin Ultrasound CT MR</i> . 2012;33(1):18-36.	Review/Other-Dx	N/A	To explore the differential diagnosis of nontraumatic abdominal pain in the pregnant patient.	No results stated in abstract.	4
90. Dietrich CF. Significance of abdominal ultrasound in inflammatory bowel disease. [Review] [65 refs]. <i>Digestive Diseases</i> . 27(4):482-93, 2009.	Review/Other-Dx	N/A	To provide an updated overview of the role of transabdominal US in IBD including Crohn's disease, ulcerative colitis, tuberculosis and neutropenic colitis while summarizing the results of recent studies with special reference to sensitivity/specificity in detecting the disease and sonomorphologic features to evaluate disease activity and its luminal and extraluminal complications.	Transabdominal US is clinically useful in the initial diagnosis of IBD by evaluating bowel wall thickness and surrounding structures including peri-intestinal inflammatory reaction, extent and localization of involved bowel segments and detection of extraluminal complications such as fistula, abscesses, carcinoma and ileus. Transabdominal US is currently accepted as a clinically important first-line tool in assessing patients with Crohn's disease irrespective of their clinical symptoms and/or disease activity.	4

**Acute Nonlocalized Abdominal Pain  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
91. Spence SC, Teichgraeber D, Chandrasekhar C. Emergent right upper quadrant sonography. J Ultrasound Med. 2009;28(4):479-496.	Review/Other-Dx	N/A	To review the sonographic spectrum of disease entities evaluated by right upper quadrant sonography on an emergent basis.	A wide gamut of acute and chronic cholecystitis and diseases of the liver and biliary tree were visualized on right upper quadrant sonography. Several other entities in addition to hepatic and biliary disease were also suspected on sonography and further evaluated by CT. Right upper quadrant sonography is the first line of imaging in patients with signs and symptoms of hepatic, gallbladder, or biliary disease as well as right upper quadrant pain. Patient triage or additional imaging may be obtained on the basis of emergent right upper quadrant sonographic findings.	4

**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
92. Leeuwenburgh MM, Stockmann HB, Bouma WH, et al. A simple clinical decision rule to rule out appendicitis in patients with nondiagnostic ultrasound results. <i>Acad Emerg Med.</i> 21(5):488-96, 2014 May.	Observational-Dx	319 patients	To identify a set of clinical features that can rule out appendicitis in patients with suspected acute appendicitis and nondiagnostic ultrasound (US) results, allowing safe discharge and next-day reevaluation without initial computed tomography (CT) or magnetic resonance imaging (MRI).	The CDR selected patients after negative or inconclusive US for discharge and next-day reevaluation without initial CT or MRI if fewer than two of the following predictors were present: male sex, migration of pain to the right lower quadrant, vomiting, and white blood cell (WBC) count higher than $12.0 \times 10^9$ /L. Applying the CDR in the development set selected 126 of 199 (63%) patients with negative or inconclusive US results for discharge without further imaging. This rule reduced the probability of appendicitis from 26% (51 of 199) in the total group of patients with negative or inconclusive US results to 12% (15 of 126) in the group that would be discharged based on the rule ( $p = 0.001$ ). In the validation set ( $n = 120$ ), the decision rule selected 72 (60%) patients for discharge and next-day reevaluation and reduced the probability of appendicitis from 20% (24 of 120) in the total group to 6% (4 of 72) in the patients selected on the rule ( $p = 0.001$ ). The negative predictive value of the decision rule in the validation set was 94% (95% confidence interval [CI] = 87% to 98%). In comparison, the negative predictive value of CT in the same group was 99% (95% CI = 93% to 100%, $p = 0.14$ ), and that of MRI was 99% (95% CI = 94% to 100%, $p = 0.12$ ). Alternative decision rules based on combinations of the present decision rule with C-reactive protein (CRP) results did not improve selection.	2
93. Puylaert JB. Ultrasound of colon diverticulitis. <i>Dig Dis.</i> 2012;30(1):56-59.	Review/Other-Dx	N/A	To discuss the ultrasound signs of diverticulitis.	No results stated in abstract.	4



**Acute Nonlocalized Abdominal Pain**  
**EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
94. Jang TB, Schindler D, Kaji AH. Bedside ultrasonography for the detection of small bowel obstruction in the emergency department. <i>Emerg Med J.</i> 2011; 28(8):676-678.	Observational-Dx	76 patients	To compare bedside US and x-ray for the detection of SBO.	In all, 76 patients were enrolled and evaluated with US for SBO. A total of 33 (43%) were diagnosed as having SBO. Dilated bowel on US had a sensitivity of 91% (95% CI: 75%-98%) and specificity of 84% (95% CI: 69%-93%) for SBO, compared to 27% (95% CI: 14%-46%) and 98% (95% CI: 86%-100%) for decreased bowel peristalsis on US. X-ray had a sensitivity of 46.2% (95% CI: 20.4%-73.9%) and specificity of 66.7% (95% CI: 48.9%-80.9%) for SBO when diagnostic, but was nondiagnostic 36% of the time.	2
95. Tracey M, Fletcher HS. Appendicitis in pregnancy. <i>Am Surg.</i> 2000;66(6):555-559; discussion 559-560.	Observational-Dx	22 patients	To perform a retrospective contemporary evaluation of pregnant patients with the diagnosis of acute appendicitis during the period 1991-1998 to further evaluate the overall incidence, to determine the factors contributing to delay in diagnosis, and to assess overall outcomes in appendicitis in pregnancy.	Nineteen patients (86%) had pathologically proven acute appendicitis. Sixteen patients (73%) presented with less than 24 hours of abdominal symptoms. Seventeen patients (77%) presented with findings of rebound and guarding on initial physical examination. Fifteen patients (68%) were taken to the operating room within 24 hours of presentation. Of these, 10 patients (68%) had acute perforated appendicitis. Overall, there were 12 cases of perforated appendicitis (55%), which is an incidence higher than what has been reported in literature. There were no instances of fetal mortality. Preterm labor occurred in 5 patients, all in their third trimester with perforated appendicitis.	4

## Evidence Table Key

### Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
  - a. The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
  - b. The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
  - c. The study is an expert opinion or consensus document.
- Meta-analysis
  - a. *Good quality* – the study design, methods, analysis, and results are valid and the conclusion is supported.
  - b. *Inadequate quality* – the study design, analysis, and results lack the methodological rigor to be considered a good meta-analysis study.

## Abbreviations Key

Dx = Diagnostic

Tx = Treatment